Fabrication and Properties of Novel 3-D Metallic Photonic Crystals

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We have successfully fabricated 3-D metallic photonic crystals with a range of different structures and have theoretically and experimentally investigated their properties. The structures were fabricated using a layer-by-layer deposition process combined with tungsten micromolding. This process is completely compatible with standard integrated circuit fabrication techniques. The structures fabricated include the simple cubic, inverse face centered cubic, inverse hexagonal closed packed, inverse hexagonal, as well as "perfect" and intentionally defective Iowa State (diamond) structures. The band edge of these structures was typically in the mid infrared and the metal used was tungsten deposited by chemical vapor deposition. We have also investigated other metals and have found that coating the tungsten can have significant effects on the properties of these structures. For example, coating tungsten Iowa State structures with a thin layer of gold increases the reflectivity and sharpens the band edge. In this presentation we will outline the fabrication processes used and the optical properties of these structures.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94-AL85000.